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Forest Service RESEARCH NOTE

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EFFECTS OF PROTECTION FROM DEER ON SURVIVAL AND GROWTH OF DOUGLAS-FIR SEEDLINGS

by

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ABSTRACT

Protection from deer had little effect on survival of planted and natural Douglas-fir seedlings after eight growing seasons. Protected trees were slightly taller than unprotected trees. Trees from natural seedfall were taller than planted trees. Unprotected planted stock was shorter than its protected counterpart and showed no sign of "catching up." This difference should be of little consequence after a cutting cycle.

Animal injuries to Douglas-fir (*Pseudotsuga menziesii*) seedlings lengthen establishment intervals in many plantations in the Pacific Northwest. Ranking high in causing injuries are black-tailed deer (*Odocoileus hemionus columbianus*). Deer browse leaders of seedlings until they are 4 or 5 feet high and feed on laterals of taller trees.

It is not known whether browsed and shortened seedlings eventually "catch up" with their unbrowsed neighbors because long-term studies under various site conditions have not been made.

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Opportunities to evaluate browsing effects are relatively rare. Mitchell[2] studied short-term effects of animal feeding on Vancouver Island, but older, long-term research studies usually did not include measures of browsing incidence or intensity. More recent studies have not been in progress long enough for meaningful results.

THE STUDY

The study was begun in 1958 by the Estacada Ranger District of the Mount Hood National Forest to determine effects of deer browsing on survival and growth of Douglas-fir seedlings. The study site was located on a moderate, northwest-facing slope, at an elevation of 1,600 feet in the Fish Creek drainage of the Clackamas River, about 40 miles southeast of Portland, Oregon. Resident deer occupy the lower Fish Creek drainage which also provides winter range for animals that summer at higher elevations. Thus, it was believed that seedlings growing there would be subjected to intensive deer browsing.

A 250- to 300-year-old stand of Douglas-fir with western hemlock (*Tsuga heterophylla*) was harvested from the low site III land in 1950. Slash was burned, and the area was subsequently reburned in 1956 by a fire which escaped during slash disposal on an adjacent unit.

Soils are derived from basalt, and vegetation is typical of lower elevation cutover forest land in the west-central Cascade Range in northern Oregon. Major woody species in 1967 included *Prunus emarginata*, *Ribes* spp., *Rubus ursinus*, *R. leucodermis*, and *Alnus rubra*. Many species of forbs and grasses were also present in the vegetative mantle.

METHODS

A square, 1-acre, deer-tight exclosure was built on an area planted with 2-0 seedlings in winter 1958-59. A scattered stocking of similar-sized natural Douglas-fir on the site permitted comparison of browsing effects on planted and natural seedlings.

A sample of 75 seedlings, 25 natural and 50 planted, was randomly selected inside and outside the exclosure. Sample trees were permanently marked and their locations plotted with compass and chain to permit subsequent relocation.

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[2] Mitchell, K. J. Height growth losses due to animal feeding in Douglas fir plantations, Vancouver Island, B. C. Forest. Chron. 40: 298-307, illus. 1964.

Initial height measurements were made at the time of sample selections. Annual examinations were begun in April 1960 just before bud burst and continued through 1967.

RESULTS AND DISCUSSION

Although the study objective was to determine effects of deer browsing, it was soon evident that clipping by snowshoe hare (*Lepus americanus*) or brush rabbits (*Sylvilagus bachmani*) also occurred. Seedlings both inside and outside the exclosure were clipped during the first 2 and last 2 years. Terminals of a few protected seedlings were clipped within the first 2 years. Although not recorded, it is likely that a similar number was clipped on unprotected seedlings. Thus, with clipping effects presumably equalized, differences in survival and height growth can be attributed to browsing by deer.

The chronological animal feeding pattern is shown in figure 1.

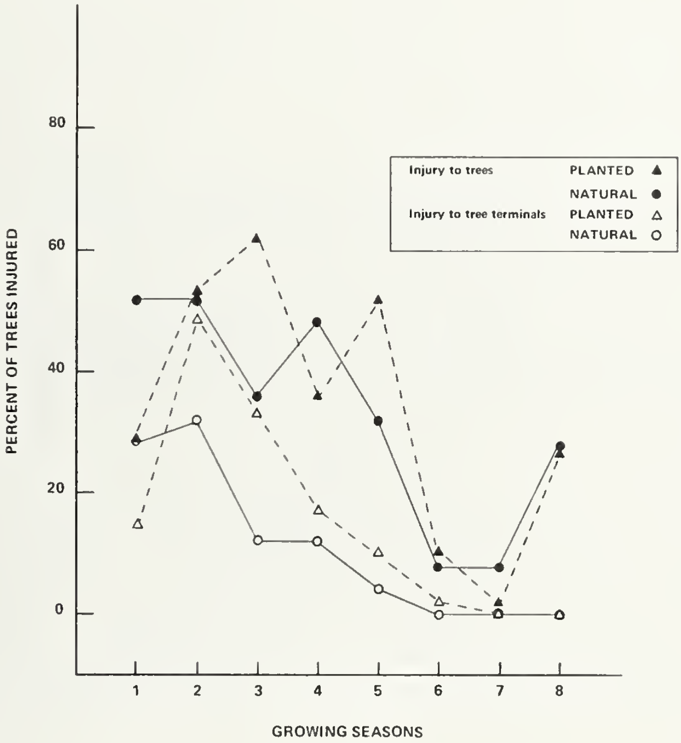

Figure 1.--Incidence of injuries to unprotected Douglas-fir trees.

After the first 2 years, percentages of terminal shoots injured were considerably lower than percentages of browsing or clipping on any part of the tree. Terminal injuries were actually much lower than had been expected prior to the establishment of the study. A "t" test revealed no significant difference in animal choice (p = 0.05) between planted and natural seedlings through the 8-year inspection period.

Through 1966, the seventh year, injuries showed a general decline (fig. 1). The upturn in 1967 was all due to minor clipping of lower laterals. Even inside the exclosure, 28 percent of all trees exhibited similar lateral clipping in 1966. The proportion clipped inside soared to 86 percent in 1967 but had negligible effect on the trees, most of which were 6 feet or more in height. The recent increase in clipping may have been associated with the progressive annual improvement of hare and rabbit habitat, especially inside the exclosure where protection from deer resulted in a dense canopy of woody and herbaceous plants. Nearly all clipping of protected and unprotected trees occurred from 2 to 4 feet above ground level, indicating that it took place when snow cover was present.

Figure 2 shows that survival of natural seedlings was higher than planted stock. This was expected because the naturals were in place and growing well when the nursery stock was planted. Survival of planted stock was also high with 80 percent of all planted trees alive after eight growing seasons.

Protection from deer had little effect on seedling survival. Seven of the 20 trees that died were browsed or clipped. Four of these were inside and three outside the exclosure.

Results of annual height measurements are illustrated in figure 3. First measurements indicated that heights were similar among natural and planted seedlings, inside and outside the exclosure. Height differences observed by the second year tended to persist or increase through the study period.

Comparison by analysis of variance indicated that, after eight growing seasons, natural trees at 10.5 feet were significantly taller (p = 0.01) than planted trees (6.7 feet). Trees inside the exclosure averaged 8.9 feet and were significantly taller (p = 0.05) than those without protection which averaged 7.4 feet in height. Close inspection of figure 3 suggests that unprotected seedlings were not "catching up" with their protected counterparts, even though terminal and all but incidental lateral browsing and clipping had ended 3 years earlier.

Although sample sizes were relatively small, results in figure 4 show that injuries to terminals depressed height growth and that repeated terminal injuries caused progressively greater height losses.

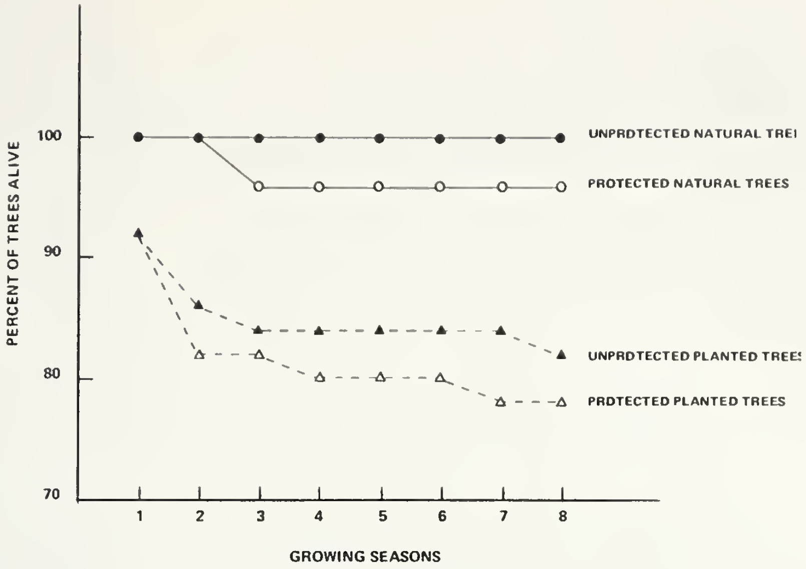

Figure 2.--Survival of protected and unprotected Douglas-fir trees.

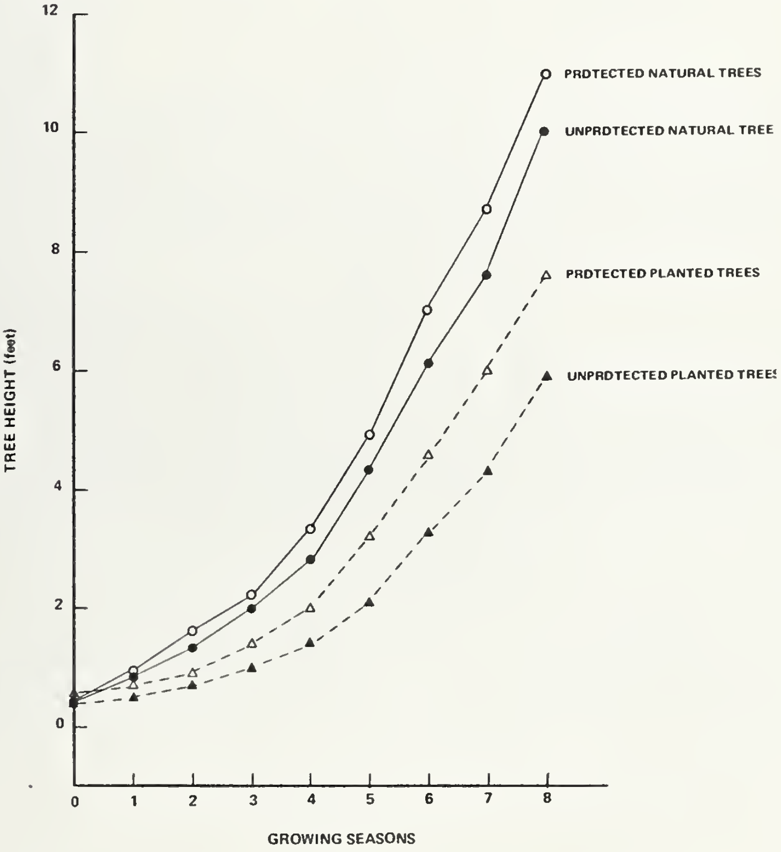

Figure 3.--Heights of protected and unprotected Douglas-fir trees.

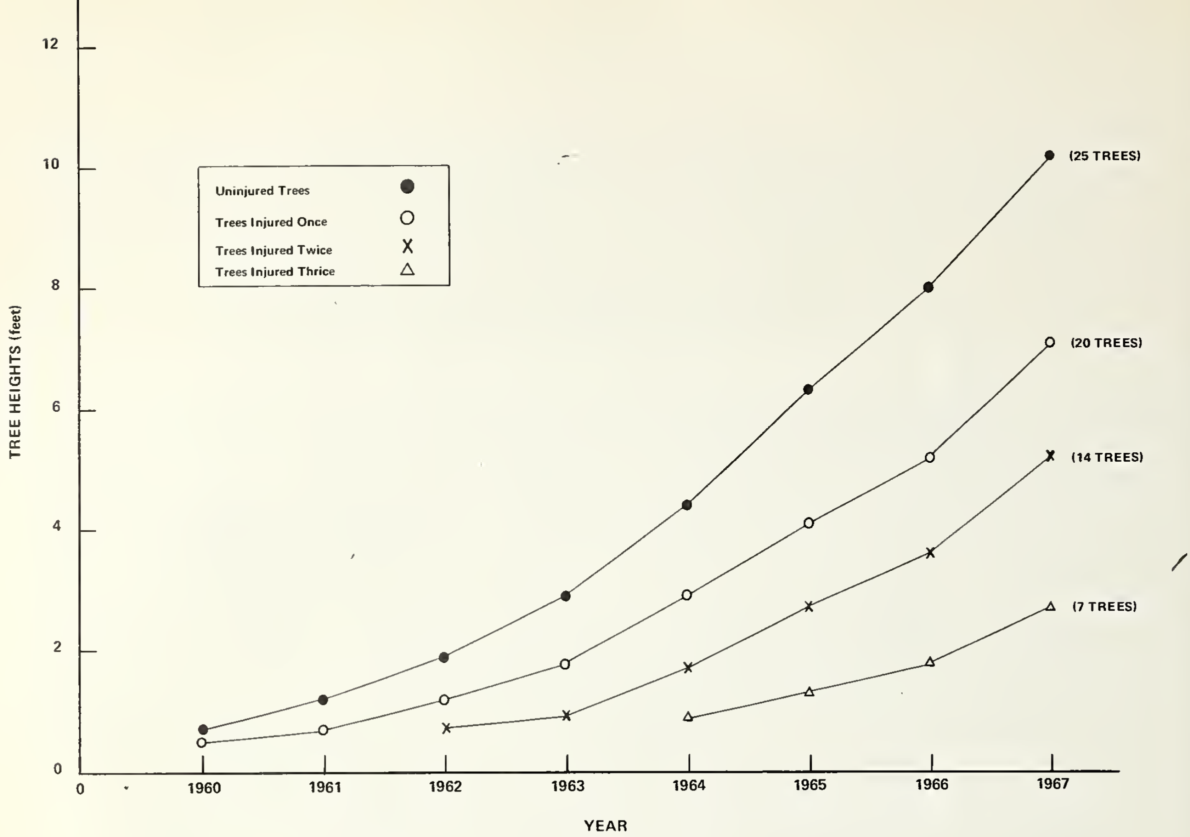

Figure 4.--Effects of terminal injuries on height growth of all unprotected Douglas-fir trees.

There is little doubt that browsing suppressed height growth of planted and natural trees. Damaging injuries, those which removed leaders, occurred through the first 5 years of the study. Trees free from leader damage for 3 additional years, although growing reasonably well, showed little signs of attaining the height of their unbrowsed neighbors.

Referring again to figure 3, one can see that the greatest comparable height difference after eight growing seasons separates protected and unprotected planted trees. This difference amounted to only 1.7 feet. If unprotected trees never catch up but continue to grow as rapidly as unbrowsed trees, the early browsing they sustained should be of little consequence after a 60- or 100-year-cutting cycle.

Probably the most important lesson to be learned from this study is that deer browsing on new seedlings does not necessarily signal a reforestation disaster. On the other hand, only constant field observation by local managers will provide the information needed to delineate those areas where browsing is likely to cause intolerable losses of productivity.